PATENT ABSTRACTS OF JAPAN

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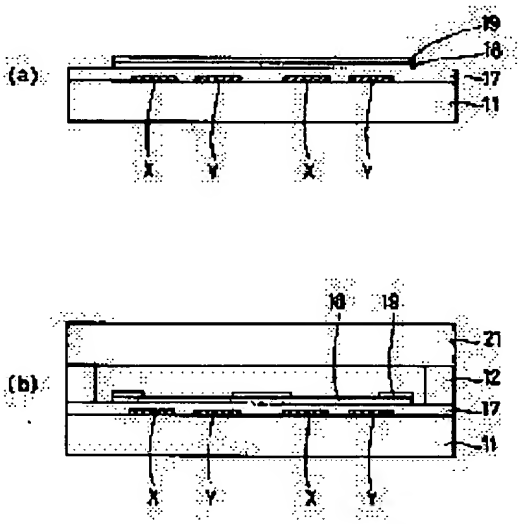
(54) MANUFACTURE OF PLASMA DISPLAY PANEL

(57)Abstract:
PROBLEM TO BE SOLVED: To prevent the generation of a transformed layer in a surface of a protecting film at the time of manufacturing, and to eliminate a necessity of decomposing the transformed layer of the surface of the protecting film so as to enable the setting of heat resistant temperature of the sealing material at a low value, and to enable the use of CaO and SrO or the like as a protecting film by coating a protecting film with a temporary protecting film at the time of manufacturing, and eliminating the temporary protecting film after assembling a panel.
SOLUTION: An inner surface of a front surface board 11 is formed with a pair of sustain electrode X, Y per each display line, and both the electrodes X, Y are coated with a dielectric film 17, and a protecting film 18 having excellent discharging characteristic is formed thereon. Continuously, a temporary protecting film 19 of Sin, which has low water permeability, is continuously formed on the protecting film 18 in the vacuum atmosphere, in which the protecting film 18 is formed, the protecting film is taken out of a vacuum vessel. The front surface board 11 and a back surface board 21 are overlapped with each other in the condition that the electrodes face to each other, and periphery thereof is sealed with the sealing material 12, and after assembling a panel, the temporary protecting film 19 is eliminated at a top surface part of the electrodes X, Y. With this structure, a transformed layer is not formed, and the protecting film 18 having excellent discharging characteristic can be obtained.



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* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] Form an electrode on one [at least] substrate of the substrate of a couple, and the electrode is covered with a dielectric film. The momentary protective coat for protecting the front face of the protective coat for protecting this dielectric film from electric discharge and this protective coat on a target temporarily [period] even like a panel assembler is formed in the front face of the dielectric film. The manufacture method of the plasma display panel which comes to contain the process which is made to generate plasma and removes a protective coat inside a panel temporarily [aforementioned] after assembling a panel by one this] substrate and the substrate of another side.

[Claim 2] The manufacture method of a plasma display panel according to claim 1 that a protective coat consists of material chosen from MgO, CaO, SrO, BaO, or the group of these compounds, and a protective coat is characterized by the bird clapper temporarily from the material chosen from SiN, SiO2, aluminum 2O3, MgO, TiO2, MgF2 and CaF2, or the group of these compounds.

[Claim 3] The manufacture method of the plasma display panel according to claim 1 characterized by for removal of a protective coat introducing the discharge gas for removal into the discharge space between the substrates of a couple, and being performed by electric discharge by the electrode temporarily.

[Claim 4] The manufacture method of the plasma display panel according to claim 3 characterized by the bird clapper from the gas by which the discharge gas for removal contains a fluorine.

[Claim 5] The manufacture method of the plasma display panel according to claim 1 characterized by removing the discharge-gas component for removal which activates a getter and is contained in a discharge gas with this activated getter after installing a getter in the interior of a panel, introducing the discharge gas for a display, and the discharge gas for removal into the discharge space between the substrates of a couple and electric discharge by the electrode removing a protective coat temporarily.

[Claim 6] The electrode insulated from the gas for electric discharge. The protective coat which consists of secondary-electron-emission material which touches the gas for electric discharge. It is the manufacture method of the plasma display panel equipped with the above, and is characterized by the bird clapper including the process which forms a protective coat on the aforementioned protective coat temporarily which protects the front face of the aforementioned protective coat on a target temporarily [period] even like a panel assembler, and the process which is made to generate plasma and removes a protective coat inside a panel after a panel assembly temporarily [aforementioned].

[Claim 7] the protective coat for a wrap dielectric layer being formed in a front face in an electrode and this electrode, and protecting the aforementioned dielectric layer from electric discharge further, and the front face of this protective coat -- the period even like a panel assembler -- the electrode substrate structure of the plasma display panel which comes to carry out the laminating of the momentary protective coat for protecting temporarily

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the manufacture method of a plasma display panel (PDP).
[0002]
[Description of the Prior Art] PDP is usually a flat and such a flat-panel display is advantageous in respect of installation nature or power consumption as compared with a CRT display.
[0003] The composition of PDP is mentioned as an example and drawing 5 explains 3 electrode side electric discharge type PDP of AC drive form for it. PDP1 has structure which the glass substrate 11 by the side of a front face (front substrate) and the glass substrate 21 by the side of a tooth back (tooth-back substrate) were made to counter, and piled them up. The SASUTIN electrodes X and Y of a couple are arranged by the inside of the front substrate 11 at every [of a matrix display] line L. As for the SASUTIN electrodes X and Y, each consists of a transparent electrode 41 and a bus electrode 42. These SASUTIN electrodes X and Y are covered with the dielectric layer 17 for AC drive, and the protective coat 18 is formed in the front face of a dielectric layer 17.
[0004] On the other hand, the stripe-like address electrode A is arranged by the inside of the tooth-back substrate 21 on the ground layer 22, and the insulating layer 24 is formed on it. On the insulating layer 24, the band-like septum 29 for dividing each address electrode A is formed. The red for color display, blue, and the green fluorescent substance layers 28R, 28G, and 28B are kicked by ** in the slot between septa 29 so that the address electrode A may be covered. Discharge space 30 is divided for every subpixel in the direction of a line by these septa 29, and the gap size of discharge space 30 is specified to constant value (for example, 150 micrometers). The discharge gas for a display is enclosed with discharge space 30. 1 pixel (pixel) of a display consists of three subpixel located in a line in the direction of a line.
[0005] After a display pixel is chosen by address electric discharge with an address electrode and one of the two's SASUTIN electrode (for example, Y electrode), in order that PDP of this AC drive method may maintain the display electric discharge, the SASUTIN electrode X is impressed, alternating voltage is impressed among Y, and field electric discharge is generated in plasma through a dielectric layer 17.
[0006] It is prepared in order that a protective coat 18 may make low breakdown voltage at the time of such electric discharge, and MgO which is the secondary-electron-emission material to which the spatter of the secondary-electron-emission efficiency cannot usually be greatly carried out easily by the discharge gas for a display as this protective coat 18 is used. As a material with such a property, CaO, SrO, etc. are known besides MgO.
[0007]
[Problem(s) to be Solved by the Invention] However, if many of material suitable for these protective coats 18 has high reactivity (deliquescence) with the moisture in air, carbon dioxide gas, etc. and it is left in after [membrane formation] air, a front face will deteriorate. therefore -- for example, when MgO is used as a protective coat, after having piled up the front substrate 11 and the tooth-back substrate 21 through discharge space 30, closing the circumference and assembling on a panel, at the time of exhaust air of the impure gas in a panel, it had to be made the elevated temperature of about about 350 degrees C, the transformation layer of this front face had to be decomposed, and the discharge gas for a display had to be enclosed with it after that
[0008] Moreover, although it was also possible as a protective coat to have used CaO, SrO, etc. in addition to MgO, since these were not able to decompose a surface transformation layer if they are not made more nearly further than MgO into an elevated temperature, practical use was not presented with them.
[0009] In addition, the manufacture method which prepared <111> orientation films of MgO in JP,5-234519,A as the formation method of the protective coat using MgO by the ion assistant vacuum deposition which irradiates the vacuum deposition method or ion beam like a publication which performs vacuum evaporationo in oxygen atmosphere as a protective coat is learned.
[0010] This invention was made in consideration of such a situation, and covers the protective coat by the protective coat temporarily at the time of manufacture. After constructing on a panel, remove a protective coat temporarily [the], and a transformation layer is made not to be formed on the surface of a protective coat by this at the time of manufacture, and the need of decomposing the transformation layer on the front face of a protective coat is abolished further. While enabling it to set up the heat-resistant temperature of a sealing agent low, the manufacture method of the plasma display panel which enabled it to use CaO, SrO, etc. as a protective coat is offered.
[0011]

[Means for Solving the Problem] This invention forms an electrode on one [at least] substrate of the substrate of a couple. Cover the electrode with a dielectric film and the momentary protective coat for protecting the front face of the protective coat for protecting this dielectric film from electric discharge and this protective coat on a target temporarily [period] even like a panel assembler is formed in the front face of the dielectric film. After assembling a panel by one [this] substrate and the substrate of another side, it is the manufacture method of the plasma display panel which comes to contain the process which is made to generate plasma and removes a protective coat inside a panel temporarily [aforementioned].
[0012] According to this invention, since a protective coat is continuously formed on it in the vacuum atmosphere after formation of a protective coat temporarily, a protective coat is not exposed into air. For this reason, the transformation layer produced by the reaction with the moisture in air, a carbonation object, etc. is not formed on the surface of a protective coat.
[0013] Moreover, since plasma is generated and a protective coat is removed inside a panel temporarily after assembling a panel by one substrate and the substrate of another side, pyrolysis processing of the transformation layer of a protective coat becomes unnecessary. Since the temperature at the time of exhaust air of the impure gas in the panel after assembling on a panel can be set up by this lower than before, it becomes possible to use the sealing agent of low heatproof temperature conventionally. Moreover, since pyrolysis processing of the transformation layer of a protective coat is unnecessary, it becomes possible to use CaO which was not able to be used conventionally, SrO, etc. as a protective coat.
[0014]
[Embodiments of the Invention] In this invention, the substrate of a couple can be constituted from a front substrate and a tooth-back substrate, and these substrates can be constituted using glass material.
[0015] If the electrode formed on one [at least] substrate of the substrate of a couple is a transparent electrode, it can be formed using ITO, a Nesa membrane, etc., and if it is a metal electrode, it can be formed using the low metal of resistance, such as silver, a three-layer metal of chromium-copper-chromium (Cr-Cu-Cr), or aluminum. A low melting glass etc. can be used as a dielectric film.
[0016] Anythings can be used for it if a protective coat is the thing of the secondary-electron-emission material to which the spatter of the secondary-electron-emission efficiency cannot be greatly carried out easily by the discharge gas for a display. As what has such a property, MgO, CaO, SrO, BaO(s), or these compounds can be mentioned. This protective coat can be formed by the CVD (chemical vacuum deposition) method or the spatter.
[0017] If a protective coat is a permeable low thing, anythings can use it temporarily. This low water permeability means the property of the grade which can prevent that the protective coat located in the lower layer of a protective coat temporarily reacts with the moisture in air, or a carbonation object, and SiN, SiO2, aluminum 2O3, MgO, TiO2, MgF2 and CaF2, or these compounds can be mentioned as what has such a property. As a sealing agent used in case one substrate and the substrate of another side are piled up, the circumference is closed and a panel is assembled, the material of a low melting glass or various kinds of organic systems can be used.
[0018] Removal of a protective coat can introduce the discharge gas for removal into the discharge space between the substrates of a couple, can be made to be able to discharge by inter-electrode, and can be performed by etching by it temporarily. Specifically, plasma etching can perform removal of a protective coat to the discharge gas for removal temporarily [this] using the gas containing the fluorine of CF4 and SF6 grade.
[0019] Although the discharge gas for the display in the case of after removal of a protective coat extracting the discharge gas for removal from the inside of a panel, and using it as a product temporarily [this] is enclosed in a panel In this case, a getter is installed in the interior of a panel, the discharge gas for a display and the discharge gas for removal are introduced into the interior of a panel, a getter is activated after removal of a protective coat temporarily by electric discharge, and you may make it remove the discharge-gas component for removal contained in a discharge gas with this activated getter.
[0020] this invention -- moreover, the protective coat for a wrap dielectric layer being formed in a front face in an electrode and this electrode, and protecting the aforementioned dielectric layer from electric discharge further and the front face of this protective coat -- the period even like a panel assembler -- it is the electrode substrate structure of the plasma display panel which comes to carry out the laminating of the momentary protective coat for protecting temporarily
[0021]
[Example] Hereafter, based on the example shown in a drawing, this invention is explained in full detail. In addition, this invention is not limited by this.
[0022] Example 1 drawing 1 is explanatory drawing showing the outline of the example 1 of the manufacture method of PDP by this invention. In addition, although this example is an example applied to 3 electrode side electric discharge type PDP shown in drawing 5 , the address electrode on a tooth-back substrate, the septum, etc. are omitting drawing. As shown in this drawing, the manufacture method of the example 1 of this invention forms the protective coat 18 which forms the SASUTIN electrodes X and Y of a couple in the inside of the front substrate 11 for every display line, covers the SASUTIN electrodes X and Y with the dielectric film 17 which consists of a low melting glass inside, and becomes it from MgO with a sufficient electric discharge property on the front face of the dielectric film 17.
[0023] And a protective coat (SiN film) 19 is continuously formed on the protective coat 18 in vacuum (reduced pressure) atmosphere in which the protective coat 18 was formed temporarily which consists of a permeable low SiN. That is, after membrane formation of the protective coat 18 by the vacuum deposition method, a protective coat 19 is formed by the RF-sputtering method within a vacuum tub temporarily, and it takes out besides a vacuum tub after that (refer to drawing 1 (a)).
[0024] Since the front face of the reactant high protective coat 18 is protected by the protective coat 19 temporarily even if the front substrate 11 will be in the state where it is taken out from a vacuum tub and exposed to the atmosphere, by doing in this

way, the front face of a protective coat 18 is intercepted from the moisture in air.
[0025] And after making electrodes counter, piling up this front substrate 11 and the tooth-back substrate 21, closing the circumference with a sealing agent 12 and assembling on a panel, only the upper surface portion (field electric discharge field) of the SASUTIN electrodes X and Y removes a protective coat 19 temporarily (refer to drawing 1 (b)).
[0026] Since the momentary protective coat 19 on a field electric discharge field is unnecessary at the time of the display electric discharge when actually using as PDP, the SASUTIN electrode X for field electric discharge is applied in the case of exhaust air of the internal gas after a panel assembly, voltage is applied among Y, field electric discharge is generated, and the so-called plasma etching using the electric discharge removes.
[0027] Drawing 2 is explanatory drawing showing the manufacture method of an example 1 for every process, and explains the manufacture method of an example 1 in detail based on this drawing.
[0028] (a) Electrode formation, a dielectric-film formation process (refer to drawing 2 (a))
A transparent electric conduction film is formed in the front face of the front substrate 11 which consists of glass by sputtering, and a transparent electrode is formed by the photolithography. ITO, a Nesa membrane, etc. are used as a material of a transparent electric conduction film. On a transparent electrode, a metal electric conduction film is formed by sputtering, and a bus electrode is formed by the photolithography. As a material of a metal electric conduction film, the low metal of resistance, such as silver, a three layer metal of Cr-Cu-Cr, and aluminum, is used. It is the SASUTIN electrodes X and Y which consist of these transparent electrodes and bus electrodes. The SASUTIN electrodes X and Y are coated with a dielectric film 17. A low melting glass is used as a material of a dielectric film 17.
[0029] (b) Protective coat formation process (refer to drawing 2 (b))
In order to raise an electric discharge property, the protective coat 18 which secondary-electron-emission efficiency becomes from MgO in which a spatter cannot be greatly carried out easily by the discharge gas for a display is formed in the front face of a dielectric film 17. Membrane formation of this protective coat 18 is performed by the vacuum deposition within a vacuum tub.
[0030] (c) Momentary protective coat formation process (refer to drawing 2 (c))
The permeable low SiN film 19 is continuously formed by the RF-sputtering method on a protective coat 18 after membrane formation of a protective coat 18, and within a vacuum tub, and a glass substrate 11 is taken out besides a vacuum tub after that.
[0031] The composition of the equipment for forming a protective coat in drawing 3 a protective coat and temporarily is shown. As shown in this drawing, in order to form a protective coat on a dielectric film a protective coat and temporarily, the front substrate 11 formed to the dielectric film 17 is taught first, and it puts into loculus (load room) 51, next the front substrate 11 is put into the protective coat membrane formation room 52. The protective coat membrane formation room 52 is oxygen pressure force 1x10-4Torr.
[0032] And for example, if MgO is used as a protective coat 18, the vacuum evaporationo of the MgO film will be carried out to the front face of a dielectric film 17 using MgO evaporation-source 52a. Then, if a high-vacuum room puts in the front substrate 11 transfer-chamber 53, and it is put into the protective coat membrane formation room 54 next temporarily, for example, SiN is used as a protective coat 19 temporarily, a SiN film will be formed succeeding a protective coat 18 top using SiN target 54a. The protective coat membrane formation room 54 is gas ** 5x10-3Torr temporarily. 56 in drawing is a vacuum pump. And the front substrate 11 is taken out, and it puts into loculus (unload room) 55, and takes out. And a seal portion is formed with the sealing agent 12 which becomes the circumference of this front substrate 11 from a low melting glass.
[0033] (d) Panel assembly exhaust air process (refer to drawing 2 (d))
A metal electric conduction film is formed in the front face of the tooth-back substrate 21 which consists of glass by sputtering, and an address electrode is formed by the photolithography. As a metal electric conduction film, the low metal of resistance, such as silver, a three layer metal of Cr-Cu-Cr, and aluminum, is used.
[0034] An address electrode is coated with an insulating layer. A low melting glass is used as a material of an insulating layer. On an insulating layer, the material layer for septa is formed extensively and a septum is formed by sandblasting processing. A low melting glass is used as a material of a septum. And a fluorescent substance paste is formed by screen-stencil into a septum.
[0035] Thus, the tooth-back substrate 21 and the front substrate 11 which were formed are made to counter so that an address electrode and a SASUTIN electrode may cross, it piles up, a temperature up is carried out in this state, a sealing agent 12 is melted, the front substrate 11 and tooth-back substrate 21 are pasted up, it assembles on a panel and the chip pipe for exhaust air is pasted up simultaneously (not shown [the chip pipe]). From a chip pipe, the interior of a panel is exhausted and gas **** is performed.
[0036] (e) Momentary protective coat removal process (refer to drawing 2 (e))
The discharge gas for removal is enclosed with the interior of a panel, alternating voltage is impressed among the SASUTIN electrodes X and Y, plasma (field electric discharge) is generated between two electrodes, and the plasma etching removes the SiN film 19 on the SASUTIN electrode X and the front face of Y. In this case, removal of the SiN film 19 performs only the upper surface portion (field electric discharge field for a display) of the SASUTIN electrodes X and Y.
[0037] Since the spatter rate is early as a discharge gas for removal when a SiN film is used as a protective coat 19 temporarily although the gas of the fluorine system of CF4 and SF6 grade was used from the ease of etching, inert gas can also be used.
[0038] Internal gas is sampled, it is filled up with the discharge gas for a display which consists of Ne+Xe, and a chip pipe is stopped. Thus, since the protective coat 18 weak to air exposure cannot touch the atmosphere, made PDP becomes a thing with the very good electric discharge property.
[0039] In example 2 this example, the MgO film is used as a protective coat 19 temporarily, using CaSrO2 very good film of the secondary emission characteristic as a protective coat 18. About the other materials, it is altogether the same as an example 1, and

is a protective coat 18 and temporarily the same as an example 1 also about the removal method of a protective coat 19 the formation method of a protective coat 19, and temporarily.
[0040] Its secondary-electron-emission efficiency is very large, and although CaSrO2 film has the feature that breakdown voltage becomes small very, it is very unstable in the atmosphere. For this reason, if it is left in air, although it will react with the moisture in air, carbon dioxide gas, etc. and a transformation layer will be formed in a front face, since the decomposition temperature of this transformation layer was very high, CaSrO2 film was not able to be used as a protective coat for PDP by the former.
[0041] However, in this invention, since a MgO film is continuously formed on CaSrO2 film in the atmosphere after forming CaSrO2 film by the vacuum deposition method, CaSrO2 film cannot touch air and a very unstable thing can also be used as a protective coat in the atmosphere like CaSrO2 film.
[0042] Although CaSrO2 film and a MgO film are continuously formed by the vacuum deposition method on a dielectric film and this MgO film is used as a protective coat in this example temporarily, since the electric discharge property of a MgO film is good, in this case, a protective coat is comparatively removable by the low battery temporarily.
[0043] In example 3 this example, electrodes are made to counter, a front substrate and a tooth-back substrate are piled up, the circumference is closed, the process assembled on a panel is the same as an example 1 or an example 2, and only the processes which remove a protective coat 19 temporarily differ.
[0044] After removing a protective coat 19 temporarily using the discharge gas for removal, it is made to change to the discharge gas for a display in an example 1 and the example 2, when removing a protective coat 19 temporarily.
[0045] What is necessary is to lose exchange of the discharge gas and to enclose a discharge gas only at once instead, a getter is installed in the interior of a panel, and it is made to remove the discharge-gas component for removal contained in a discharge gas by the getter after removal of a protective coat 19 in this example temporarily by plasma etching.
[0046] Drawing 4 is explanatory drawing showing the manufacture method of an example 3, and explains the manufacture method of an example 3 in detail based on this drawing. In this example, a getter 31 is installed in the interior of the panel which consists of a front substrate 11 and a tooth-back substrate 21, for example, a chip pipe. And for example, if CF4 is used as a discharge gas for removal, using Ne+Xe as a discharge gas for a display, both will be mixed, it will introduce into the interior of a panel, and plasma etching will remove a protective coat 19 temporarily. The component of the discharge gas inside the panel at this time is Ne+Xe+CF4+O2 mostly (refer to drawing 4 (a)).
[0047] Then, the getter 31 is activated by laser radiation etc. (refer to drawing 4 (b)). Thus, this activated getter is made to absorb the component of CF4+O2 contained in a discharge gas at the time of panel operation. Thereby, the component of the discharge gas inside a panel approaches Ne+Xe infinite (refer to drawing 4 (c)).
[0048] In this case, the discharge gas for a display and the discharge gas for removal may be introduced simultaneously, and you may make it introduce into the interior of a panel what mixed both beforehand. Thereby, the inside of a panel can be changed into the gas state suitable for display electric discharge, without replacing the discharge gas in a panel.
[0049] In addition, although 3 electrode side electric discharge type PDP of AC drive form which divided the address electrode and the SASUTIN electrode pair into two substrates which counter, and has arranged them altogether in the above-mentioned examples 1-3 was mentioned as the example and explained 3 electrode side electric discharge type PDP which will have arranged the three aforementioned electrode on the substrate of one side if this invention was AC drive form, It is possible to apply to general-purpose 2 electrode opposite electric discharge type PDP which divided 2 of X electrode and Y electrode electrodes into two substrates which counter, and has arranged them, 2 electrode side electric discharge type PDP which has arranged X electrode and Y electrode on the substrate of one side.
[0050]
[Effect of the Invention] According to this invention, after formation of a protective coat, since a protective coat is continuously formed on it temporarily, a transformation layer is not formed on the surface of a protective coat, but let the protective coat of PDP be the protective coat of a good electric discharge property. Moreover, since a protective coat is removed by generating plasma inside a panel temporarily after assembling a panel by one substrate and the substrate of another side, pyrolysis processing of the transformation layer of a protective coat becomes unnecessary, and this becomes possible to use the sealing agent of low heatproof temperature conventionally. Moreover, it becomes possible to use CaO which was not able to be used conventionally, SrO, etc. as a protective coat.

[Translation done.]

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ABSTRACT:

PROBLEM TO BE SOLVED: To prevent the generation of a transformed layer in a surface of a protecting film at the time of manufacturing, and to eliminate a necessity of decomposing the transformed layer of the surface of the protecting film so as to enable the setting of heat resistant temperature of the sealing material at a low value, and to enable the use of CaO and SrO or the like as a protecting film by coating a protecting film with a temporary protecting film at the time of manufacturing, and eliminating the temporary protecting film after assembling a panel.

SOLUTION: An inner surface of a front surface board 11 is formed with a pair of sustain electrode X, Y per each display line, and both the

electrodes X, Y are coated with a dielectric film 17, and a protecting film 18 having excellent discharging characteristic is formed thereon. Continuously, a temporary protecting film 19 of Sin, which has low water permeability, is continuously formed on the protecting film 18 in the vacuum atmosphere, in which the protecting film 18 is formed, the protecting film is taken out of a vacuum vessel. The front surface board 11 and a back surface board 21 are overlapped with each other in the condition that the electrodes face to each other, and periphery thereof is sealed with the sealing material 12, and after assembling a panel, the temporary protecting film 19 is eliminated at a top surface part of the electrodes X, Y. With this structure, a transformed layer is not formed, and the protecting film 18 having excellent discharging characteristic can be obtained.

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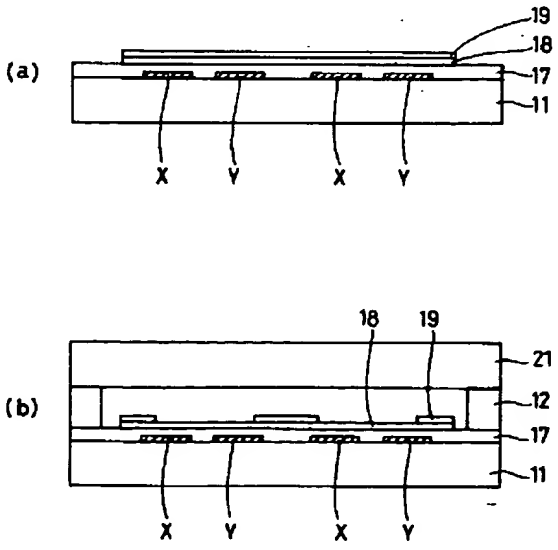
(54)【発明の名称】　プラズマディスプレイパネルの製造方法

(57)【要約】

【課題】　ＰＤＰの製造方法に関し、製造時に保護膜を一時保護膜で覆っておき、良好な放電特性を得る。

【解決手段】　前面基板と背面基板にそれぞれ電極を形成し、前面基板の電極を誘電体膜で被覆し、その誘電体膜の表面に、誘電体膜を放電から保護するための保護膜とその保護膜の表面をパネル組み立て工程までの期間一時的に保護するための一時保護膜を形成し、前面基板と背面基板とでパネルを組み立てた後、一時保護膜をプラズマエッチングにより除去する。

本発明によるPDPの製造方法の実施例1の概要を示す説明図



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【特許請求の範囲】

【請求項１】　一対の基板の少なくとも一方の基板上に電極を形成し、その電極を誘電体膜で被覆し、その誘電体膜の表面に、該誘電体膜を放電から保護するための保護膜と該保護膜の表面をパネル組み立て工程までの期間一時的に保護するための一時保護膜を形成し、該一方の基板と他方の基板とでパネルを組み立てた後、パネル内部にプラズマを発生させて前記一時保護膜を除去する工程を含んでなるプラズマディスプレイパネルの製造方法。

【請求項２】　保護膜が、ＭｇＯ、ＣａＯ、ＳｒＯ、ＢａＯ、あるいはこれらの化合物のグループ中から選択された材料からなり、一時保護膜が、ＳｉＮ、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、MgF_2、CaF_2、あるいはこれらの化合物のグループ中から選択された材料からなることを特徴とする請求項１記載のプラズマディスプレイパネルの製造方法。

【請求項３】　一時保護膜の除去が、一対の基板間の放電空間に除去用の放電ガスを導入し、電極による放電により行われることを特徴とする請求項１記載のプラズマディスプレイパネルの製造方法。

【請求項４】　除去用の放電ガスがフッ素を含むガスからなることを特徴とする請求項３記載のプラズマディスプレイパネルの製造方法。

【請求項５】　パネルの内部にゲッタを設置し、一対の基板間の放電空間に表示用の放電ガスと除去用の放電ガスとを導入し、電極による放電により一時保護膜を除去した後、ゲッタを活性化し、この活性化したゲッタで放電ガス中に含まれる除去用の放電ガス成分を除去することを特徴とする請求項１記載のプラズマディスプレイパネルの製造方法。

【請求項６】　放電用のガスから絶縁された電極と、放電用のガスと接する２次電子放出材料からなる保護膜を備えた構成のプラズマディスプレイパネルの製造方法であって、

前記保護膜の表面をパネル組み立て工程までの期間一時的に保護する一時保護膜を前記保護膜上に形成する工程と、パネル組み立て後にパネル内部にプラズマを発生させて前記一時保護膜を除去する工程とを含んでなることを特徴とするプラズマディスプレイパネルの製造方法。

【請求項７】　表面に電極と該電極を覆う誘電体層が形成され、さらに前記誘電体層を放電から保護するための保護膜と、該保護膜の表面をパネル組み立て工程までの期間一時的に保護するための一時保護膜を積層してなるプラズマディスプレイパネルの電極基板構造体。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、プラズマディスプレイパネル（ＰＤＰ）の製造方法に関する。

【０００２】

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【従来の技術】ＰＤＰは通常フラットであり、このようなフラットパネルディスプレイはＣＲＴディスプレイに比較して、設置性や電力消費の点で有利である。

【０００３】ＰＤＰの構成をＡＣ駆動形式の３電極面放電型ＰＤＰを例に挙げて図５により説明する。ＰＤＰ１は、前面側のガラス基板（前面基板）１１と背面側のガラス基板（背面基板）２１とを対向させて重ね合わせた構造となっている。前面基板１１の内面には、マトリクス表示のラインＬ毎に一対のサスティン電極Ｘ，Ｙが配列されている。サスティン電極Ｘ，Ｙは、それぞれが透明電極４１とバス電極４２とからなっている。このサスティン電極Ｘ，ＹはＡＣ駆動のための誘電体層１７で被覆され、誘電体層１７の表面には保護膜１８が形成されている。

【０００４】一方、背面基板２１の内面には、下地層２２の上にストライプ状のアドレス電極Ａが配列され、その上に絶縁層２４が形成されている。絶縁層２４上には、各アドレス電極Ａを区画するための帯状の隔壁２９が形成されている。隔壁２９間の溝には、アドレス電極Ａを被覆するように、カラー表示のための赤、青、緑の蛍光体層２８Ｒ，２８Ｇ，２８Ｂが塗分けられている。これらの隔壁２９によって放電空間３０がライン方向にサブピクセル毎に区画され、かつ放電空間３０の間隙寸法が一定値（例えば１５０μｍ）に規定されている。放電空間３０には表示用の放電ガスが封入されている。表示の１ピクセル（画素）は、ライン方向に並ぶ３つのサブピクセルからなる。

【０００５】このＡＣ駆動方式のＰＤＰは、表示画素がアドレス電極と片方のサスティン電極（例えばＹ電極）とのアドレス放電によって選択された後は、その表示放電を維持するために、サスティン電極Ｘ，Ｙ間に交流電圧を印加し、誘電体層１７を介してプラズマ中に面放電を発生させる。

【０００６】保護膜１８は、このような放電時の放電開始電圧を低くするために設けられており、この保護膜１８としては、通常、２次電子放出効率が大きく、かつ表示用の放電ガスによってスパッタされにくい２次電子放出材料であるＭｇＯが用いられている。このような性質を持つ材料としては、ＭｇＯ以外にも、ＣａＯ、ＳｒＯ等が知られている。

【０００７】

【発明が解決しようとする課題】しかしながら、これらの保護膜１８に適した材料の多くは、空気中の水分や炭酸ガス等との反応性（潮解性）が高く、成膜後空気中に放置すると表面が変質してしまう。そのため、例えば保護膜としてＭｇＯを用いた場合には、前面基板１１と背面基板２１とを放電空間３０を介して重ね合わせて周辺を封止しパネルに組み立てた後、パネル内の不浄ガスの排気時に、約３５０℃程度の高温にしてこの表面の変質層を分解し、その後、表示用の放電ガスを封入しなけれ

ばならなかった。

【0008】また、保護膜としては、MgO以外にCaO、SrO等を用いることも可能であるが、これらはMgOよりもさらに高温にしなければ表面の変質層を分解することができないため、実用に供されてはいなかった。

【0009】なお、MgOを用いた保護膜の形成方法としては、特開平5－234519号公報に記載のような、保護膜として、蒸着を酸素雰囲気中で行う真空蒸着法またはイオンビームを照射するイオンアシスト蒸着法によって、MgOの〈111〉配向膜を設けるようにした製造方法などが知られている。

【0010】この発明は、このような事情を考慮してなされたもので、製造時には保護膜を一時保護膜で覆っておき、パネルに組んだ後にその一時保護膜を除去するようにし、これにより製造時に保護膜の表面に変質層が形成されないようにし、さらに、保護膜表面の変質層を分解する必要をなくして、封止材の耐熱温度を低く設定できるようにするとともに、保護膜としてCaOやSrO等を用いることができるようにしたプラズマディスプレイパネルの製造方法を提供するものである。

【0011】

【課題を解決するための手段】この発明は、一対の基板の少なくとも一方の基板上に電極を形成し、その電極を誘電体膜で被覆し、その誘電体膜の表面に、該誘電体膜を放電から保護するための保護膜と該保護膜の表面をパネル組み立て工程までの期間一時的に保護するための一時保護膜を形成し、該一方の基板と他方の基板とでパネルを組み立てた後、パネル内部にプラズマを発生させて前記一時保護膜を除去する工程を含んでなるプラズマディスプレイパネルの製造方法である。

【0012】この発明によれば、保護膜の形成後、その真空雰囲気中でその上に連続的に一時保護膜を形成するので、保護膜が空気中にさらされることがない。このため、保護膜の表面に、空気中の水分や炭酸化物等との反応によって生ずる変質層が形成されない。

【0013】また、一方の基板と他方の基板とでパネルを組み立てた後、パネル内部にプラズマを発生させて一時保護膜を除去するので、保護膜の変質層の熱分解処理が不要となる。これにより、パネルに組み立てた後のパネル内の不浄ガスの排気時の温度を従来よりも低く設定することができるので、従来よりも低い耐熱温度の封止材を使用することが可能となる。また、保護膜の変質層の熱分解処理が不要であるので、従来用いることができなかったCaO、SrO等を保護膜として用いることが可能となる。

【0014】

【発明の実施の形態】この発明において、一対の基板は前面基板と背面基板から構成することができ、これらの基板は、ガラス材を用いて構成することができる。

【0015】一対の基板の少なくとも一方の基板上に形成される電極は、透明電極であればITOやネサ膜等を用いて形成することができ、金属電極であれば銀、クロム－銅－クロム（Cr－Cu－Cr）の三層金属、またはアルミ等の抵抗の低い金属を用いて形成することができる。誘電体膜としては、低融点ガラス等を用いることができる。

【0016】保護膜は、2次電子放出効率が大きく、かつ表示用の放電ガスによってスパッタされにくい2次電子放出材料のものであれば、どのようなものでも用いることができる。このような性質を有するものとして、例えば、MgO、CaO、SrO、BaO、あるいはこれらの化合物を挙げることができる。この保護膜は、CVD（化学蒸着）法やスパッタ法により形成することができる。

【0017】一時保護膜は、透水性の低いものであれば、どのようなものでも用いることができる。この低い透水性とは、一時保護膜の下層に位置する保護膜が空気中の水分や炭酸化物と反応することを阻止できる程度の性質を意味し、このような性質を有するものとして、例えば、SiN、SiO_2、Al_2O_3、MgO、TiO_2、MgF_2、CaF_2、あるいはこれらの化合物を挙げることができる。一方の基板と他方の基板とを重ね合わせて周辺を封止しパネルを組み立てる際に用いられる封止材としては、低融点ガラスや各種の有機系の材料を用いることができる。

【0018】一時保護膜の除去は、一対の基板間の放電空間に除去用の放電ガスを導入し、電極間で放電させ、それによるエッチングで行うことができる。具体的には、この一時保護膜の除去は、除去用の放電ガスに、例えば、CF_4、SF_6等のフッ素を含むガスを用いて、プラズマエッチングにより行うことができる。

【0019】この一時保護膜の除去後は、除去用の放電ガスをパネル内から抜き去り、製品として使用する場合の表示用の放電ガスをパネル内に封入するのであるが、この場合、パネル内部にゲッタを設置し、パネル内部に表示用の放電ガスと除去用の放電ガスとを導入し、放電による一時保護膜の除去後、ゲッタを活性化し、この活性化したゲッタで放電ガス中に含まれる除去用の放電ガス成分を除去するようにしてもよい。

【0020】この発明は、また、表面に電極と該電極を覆う誘電体層が形成され、さらに前記誘電体層を放電から保護するための保護膜と、該保護膜の表面をパネル組み立て工程までの期間一時的に保護するための一時保護膜を積層してなるプラズマディスプレイパネルの電極基板構造体である。

【0021】

【実施例】以下、図面に示す実施例に基づいてこの発明を詳述する。なお、これによってこの発明が限定されるものではない。

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【0022】実施例1

図1は本発明によるPDPの製造方法の実施例1の概要を示す説明図である。なお、この実施例は図5に示された3電極面放電型PDPに適用した例であるが、背面基板上のアドレス電極、隔壁などは図を省略している。この図に示すように、本発明の実施例1の製造方法は、前面基板11の内面に、表示ライン毎に一対のサスティン電極X，Yを形成し、そのサスティン電極X，Yを低融点ガラスからなる誘電体膜17で被覆し、その誘電体膜17の表面に放電特性の良いMgOからなる保護膜18を形成する。

【0023】そして、保護膜18を形成した真空（減圧）雰囲気中で連続的にその保護膜18上に透水性の低いSiNからなる一時保護膜（SiN膜）19を形成する。すなわち、真空蒸着法による保護膜18の成膜後に、真空槽内で高周波スパッタリング法で一時保護膜19を成膜し、その後、真空槽の外に取り出す（図1（a）参照）。

【0024】このようにすることにより、前面基板11が真空槽から取り出され大気にさらされる状態になっても、反応性の高い保護膜18の表面が一時保護膜19により保護されているために、保護膜18の表面は空気中の水分から遮断される。

【0025】そして、この前面基板11と背面基板21とを、電極どうしを対向させて重ね合わせて周辺を封止材12で封止しパネルに組み立てた後、一時保護膜19をサスティン電極X，Yの上面部分（面放電領域）だけ除去する（図1（b）参照）。

【0026】面放電領域上の一時保護膜19は、実際にPDPとして用いるときの表示放電時には不要であるため、パネル組み立て後の内部ガスの排気の際に、面放電用のサスティン電極X，Y間に電圧を加えて面放電を発生させ、その放電を利用したいわゆるプラズマエッチングにより除去する。

【0027】図2は実施例1の製造方法を工程毎に示す説明図であり、この図に基づいて、実施例1の製造方法を詳細に説明する。

【0028】（a）電極形成、誘電体膜形成工程（図2（a）参照）

ガラスからなる前面基板11の表面にスパッタリングにより透明導電膜を形成し、フォトリソグラフィにより透明電極を形成する。透明導電膜の材料としてはITO、ネサ膜等を用いる。透明電極の上に、スパッタリングにより金属導電膜を形成し、フォトリソグラフィによりバス電極を形成する。金属導電膜の材料としては銀、Cr－Cu－Cr三層金属、アルミ等の抵抗の低い金属を用いる。これらの透明電極とバス電極からなるものがサスティン電極X，Yである。サスティン電極X，Yを誘電体膜17でコーティングする。誘電体膜17の材料としては低融点ガラスを用いる。

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【0029】（b）保護膜形成工程（図2（b）参照）

放電特性を向上させるために、誘電体膜17の表面に、2次電子放出効率が大きく、かつ表示用の放電ガスによってスパッタされにくいMgOからなる保護膜18を形成する。この保護膜18の成膜は真空槽内で蒸着法で行う。

【0030】（c）一時保護膜形成工程（図2（c）参照）

保護膜18の成膜後、真空槽内で連続的に保護膜18上に、透水性の低いSiN膜19を高周波スパッタリング法で成膜し、その後、ガラス基板11を真空槽の外に取り出す。

【0031】図3に保護膜と一時保護膜を形成するための装置の構成を示す。この図に示すように、誘電体膜上に保護膜と一時保護膜を形成するには、まず、誘電体膜17まで形成した前面基板11を仕込み室（ロード室）51に入れ、次に、前面基板11を保護膜成膜室52に入れる。保護膜成膜室52は酸素圧力1×10^{-4}Torrである。

【0032】そして、例えば、保護膜18としてMgOを用いるのであれば、MgO蒸発源52aを用いて、誘電体膜17の表面にMgO膜を蒸着する。続いて、前面基板11を、高真空室のトランスファチャンバ53入れて、次に一時保護膜成膜室54に入れ、例えば、一時保護膜19としてSiNを用いるのであれば、SiNターゲット54aを用いて、保護膜18の上に連続してSiN膜を形成する。一時保護膜成膜室54はガス圧5×10^{-3}Torrである。図中56は真空ポンプである。そして、前面基板11を取りだし室（アンロード室）55に入れて取り出す。そして、この前面基板11の周囲に、低融点ガラスからなる封止材12でシール部分を形成する。

【0033】（d）パネル組み立て排気工程（図2（d）参照）

ガラスからなる背面基板21の表面にスパッタリングにより金属導電膜を形成し、フォトリソグラフィによりアドレス電極を形成する。金属導電膜としては銀、Cr－Cu－Cr三層金属、アルミ等の抵抗の低い金属を用いる。

【0034】アドレス電極を絶縁層でコーティングする。絶縁層の材料としては低融点ガラスを用いる。絶縁層上に隔壁用の材料層を全面的に形成し、サンドブラスト加工により隔壁を形成する。隔壁の材料としては低融点ガラスを用いる。そして、隔壁の中に蛍光体ペーストをスクリーン印刷により形成する。

【0035】このようにして形成した背面基板21と前面基板11とを、アドレス電極とサスティン電極とが交差するように対向させて重ね合わせ、この状態で昇温し、封止材12を溶かして、前面基板11と背面基板21どうしを接着してパネルに組み立て、同時に排気のた

めのチップ管を接着する（チップ管は図示していない）。チップ管よりパネルの内部を排気してガス出しを行う。

【0036】（e）一時保護膜除去工程（図2（e）参照）

除去用の放電ガスをパネルの内部に封入し、サスティン電極X，Y間に交流電圧を印加して、両電極間にプラズマ（面放電）を発生させ、サスティン電極X，Y表面のSiN膜19をそのプラズマエッチングにより除去する。この場合、SiN膜19の除去は、サスティン電極X，Yの上面部分（表示用の面放電領域）だけ行う。

【0037】除去用の放電ガスとしては、エッチングの容易さからCF_4、SF_6等のフッ素系のガスを用いたが、一時保護膜19としてSiN膜を用いた場合にはスパッタレートが早いので、不活性ガスを用いることもできる。

【0038】内部のガスを抜き取り、Ne＋Xeからなる表示用の放電ガスを充填し、チップ管を封じる。このようにしてできたPDPは、大気暴露に弱い保護膜18が大気に触れないために、非常に良い放電特性を有したものとなる。

【0039】実施例2

本実施例においては、保護膜18として、2次電子放出特性の非常に良い$CaSrO_2$膜を用い、一時保護膜19としてMgO膜を用いている。その他の材料については全て実施例1と同じであり、保護膜18と一時保護膜19の形成方法、および一時保護膜19の除去方法についても実施例1と同じである。

【0040】$CaSrO_2$膜は、2次電子放出効率が非常に大きく、放電開始電圧が大変に小さくなるという特徴を有しているが、大気中で極めて不安定である。このため、$CaSrO_2$膜は、空気中に放置すると、空気中の水分や炭酸ガス等と反応し表面に変質層が形成されてしまうが、この変質層の分解温度が非常に高いために、従来では、PDP用の保護膜として用いることができなかった。

【0041】しかしながら、本発明においては、$CaSrO_2$膜を真空蒸着法により形成した後、その雰囲気中で連続的に$CaSrO_2$膜上にMgO膜を形成するので、$CaSrO_2$膜が空気に触れることがなく、$CaSrO_2$膜のように大気中で極めて不安定なものでも、保護膜として用いることができる。

【0042】本実施例では誘電体膜上に真空蒸着法で$CaSrO_2$膜とMgO膜を連続的に形成し、このMgO膜を一時保護膜として用いているが、この場合には、MgO膜の放電特性が良いので、一時保護膜の除去を比較的低電圧で行うことができる。

【0043】実施例3

本実施例においては、前面基板と背面基板とを電極どうしを対向させて重ね合わせて周辺を封止し、パネルに組み立てる工程までは、実施例1または実施例2と同じであり、一時保護膜19を除去する工程のみが異なる。

【0044】実施例1および実施例2では、一時保護膜19を除去する場合、除去用の放電ガスを用いて一時保護膜19を除去した後、表示用の放電ガスに入れ替えるようにしている。

【0045】本実施例においては、その放電ガスの入れ替えをなくし、一度だけ放電ガスを封入すればよいようにし、そのかわり、パネル内部にゲッタを設置し、プラズマエッチングによる一時保護膜19の除去後、ゲッタによって放電ガス中に含まれる除去用の放電ガス成分を除去するようにしている。

【0046】図4は実施例3の製造方法を示す説明図であり、この図に基づいて、実施例3の製造方法を詳細に説明する。本実施例においては、前面基板11と背面基板21からなるパネルの内部、例えばチップ管内に、ゲッタ31を設置する。そして、例えば、表示用の放電ガスとしてNe＋Xeを用い、除去用の放電ガスとしてCF_4を用いるのであれば、両者を混合して、パネル内部に導入し、プラズマエッチングによって一時保護膜19を除去する。この時のパネル内部の放電ガスの成分は、ほぼ、Ne＋Xe＋CF_4＋O_2である（図4（a）参照）。

【0047】その後、レーザ照射等によってゲッタ31を活性化しておく（図4（b）参照）。このようにして、パネル動作時に、放電ガス中に含まれるCF_4＋O_2の成分をこの活性化したゲッタに吸収させる。これにより、パネル内部の放電ガスの成分は、限りなくNe＋Xeに近づく（図4（c）参照）。

【0048】この場合、パネル内部には、表示用の放電ガスと除去用の放電ガスとを同時に導入してもよいし、あらかじめ両者を混合したものを導入するようにしてもよい。これにより、パネル内の放電ガスを入れ替えることなく、パネル内を表示放電に適したガス状態にすることができる。

【0049】なお、上記実施例1～3においては、全てアドレス電極とサスティン電極対とを対向する2つの基板に分けて配置したAC駆動形式の3電極面放電型PDPを例に挙げて説明したが、本発明は、AC駆動形式であれば、前記3電極を片側の基板上に配置した3電極面放電型PDP、X電極とY電極の2電極を対向する2つの基板に分けて配置した汎用の2電極対向放電型PDP、X電極とY電極を片側の基板上に配置した2電極面放電型PDPなどにも適用することが可能である。

【0050】

【発明の効果】この発明によれば、保護膜の形成後、その上に連続的に一時保護膜を形成するので、保護膜の表面に変質層が形成されず、PDPの保護膜を良好な放電特性の保護膜とすることができる。また、一方の基板と他方の基板とでパネルを組み立てた後、一時保護膜をパ

ネル内部にプラズマを発生させることにより除去するので、保護膜の変質層の熱分解処理が不要となり、これにより、従来よりも低い耐熱温度の封止材を使用することが可能となる。また、従来用いることができなかったＣａＯ、ＳｒＯ等を保護膜として用いることが可能となる。

【図面の簡単な説明】

【図１】本発明によるＰＤＰの製造方法の実施例１の概要を示す説明図である。

【図２】実施例１の製造方法を工程毎に示す説明図である。

【図３】保護膜と一時保護膜を形成するための装置の構成を示す説明図である。

【図４】実施例３の製造方法を示す説明図である。

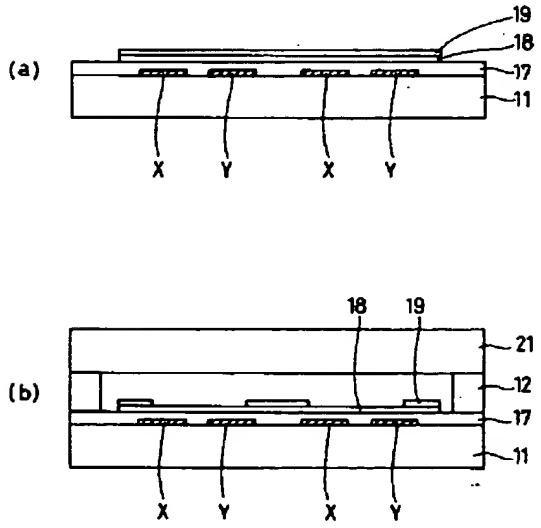
【図５】ＡＣ駆動形式の面放電型ＰＤＰの構成を示す説明図である。

【符号の説明】

１１　前面基板
１２　封止材
１７　誘電体膜
１８　保護膜
１９　一時保護膜
２１　背面基板
３１　ゲッタ
５１　仕込み室
５２　保護膜成膜室
５２ａ　ＭｇＯ蒸発源
５３　トランスファチャンバ
５４　一時保護膜成膜室
５４ａ　ＳｉＮターゲット
５５　取りだし室
５６　真空ポンプ
Ｘ，Ｙ　サスティン電極

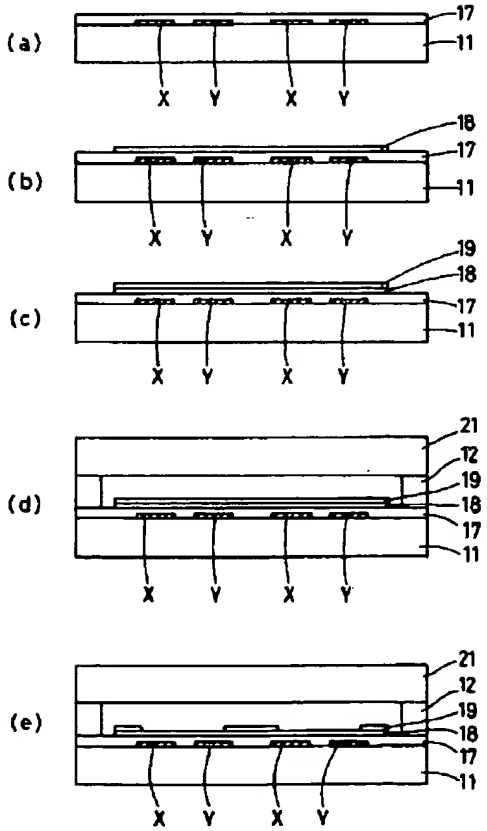
【図１】

本発明によるPDPの製造方法の実施例1の概要を示す説明図



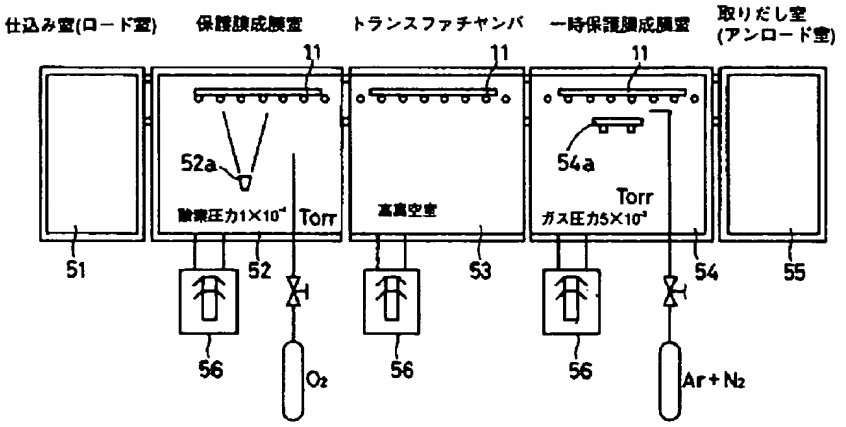
【図２】

実施例1の製造方法を工程毎に示す説明図



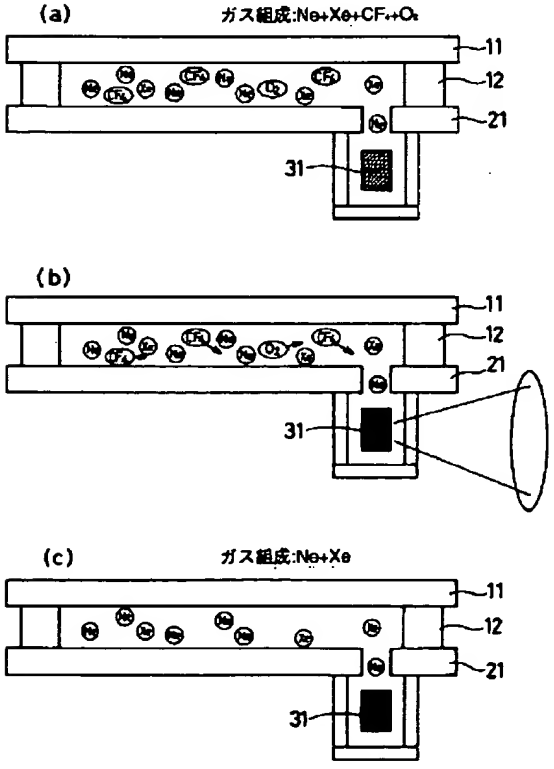
【図３】

一時保護膜を形成するための装置の構成を示す説明図



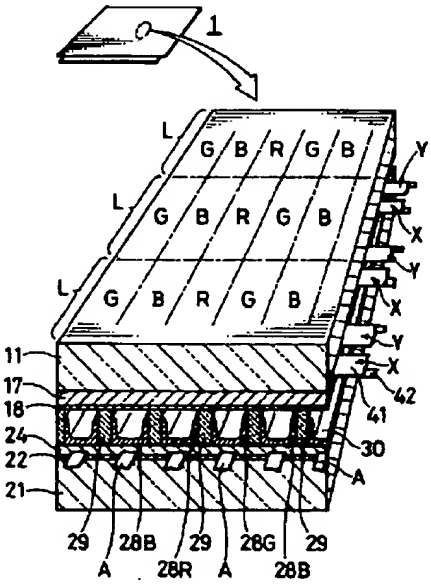
【図４】

実施例3の製造方法を示す説明図



【図５】

AC駆動形式の面放電型PDPの構成を示す説明図



* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to improvement of the secondary-electron-emission material which forms the protective layer of a dielectric layer in AC type plasma display panel.
[0002] Although there are direct electric discharge type (DC form PDP) and indirect electric discharge type PDP (AC form PDP) in a plasma display (henceforth, PDP), PDP has the features, like display quality's being good and a speed of response are quick with that big-screen-izing is easy and a spontaneous light type, and since thin-shape-izing is possible, its attention is paid to it as a display for wall tapestries with the liquid crystal device (LCD) etc.
[0003]
[Description of the Prior Art] the electric discharge maintenance electrode pair which is the principle view of AC form PDP which drawing 1 is generally used and takes a field electric discharge type, and makes two electrodes 2 and 3 a group on the tooth-back glass substrate 1 -- pattern formation of 4 is carried out, this electric discharge maintenance electrode pair 4 is covered with the dielectric layer 5 which consists of glass, and this dielectric layer 5 is further protected by the thin protective layer 6 which consists of a magnesia (MgO)
[0004] On the other hand, for the fluorescent substance layer 9, in the rear face of the front-windshield substrate 8, a pattern formation ****** cage, and this front-windshield substrate 8 and the tooth-back glass substrate 1 are several 10 micrometers. ****** opposite of the slit is carried out and reduced pressure enclosure of the inert gas 10 which generates ultraviolet rays by electric discharge in the meantime is carried out.
[0005] and an electric discharge maintenance electrode pair -- although ultraviolet rays are generated in case inert gas 10 dissociates to an electron and ion by the line of electric force 11 produced circularly and this recombines among two poles, if AC voltage is applied between the electrodes 2 and electrodes 3 which form 4 and this reaches breakdown voltage (Vf), the display is performed using the fluorescent substance layer 9 coloring in response to irradiation of the ultraviolet rays 12
[0006] **** -- as inert gas 10 -- for example, neon (Ne) Mixed gas and helium (helium) with a xenon (Xe) the material which generates many ultraviolet rays uses it in the case of electric discharge, such as mixed gas with a xenon (Xe), -- having -- **** -- as the formation material of a dielectric layer 5 -- the glass of a lead-oxide (PbO) system -- moreover -- as the formation material of a protective layer 6 -- ****** -- the magnesia (MgO) is used
[0007] By ****, the reason for forming a protective layer 6 on a dielectric layer 5 is for preventing destruction of the dielectric layer 5 by the collision of the ion produced by electric discharge, it does in this way and PDP is formed.
[0008]
[Problem(s) to be Solved by the Invention] The technical problem of AC type PDP needs to make a pixel small, i.e., to reduce the inter-electrode distance of an electric discharge maintenance electrode pair, and it is a technical problem to find out the method.
[0009]
[Means for Solving the Problem] The above-mentioned technical problem can be attained in AC type PDP by constituting the protective layer which protects the dielectric layer which has covered the electric discharge maintenance electrode pair from a fluorination magnesia expressed with the general formula of MgO1-x-y Fy (however, $0< x<1$, $0< y<1$).
[0010]
[Function] Although a protective layer is required in order to protect the dielectric layer which consists of glass in AC type PDP from destruction by the ion bombardment, and MgO is used, the requirement of this protective layer is a big secondary-emission ratio (gamma) in addition to being strong to an ion bombardment.
[0011] the ion which the reason reached breakdown voltage (Vf), and inert gas ionized it, and was produced -- a protective layer -- colliding -- the interior -- although generating of secondary electron takes place from the material which permeated deeply and collided in response to this kinetic energy, in order to lower the breakdown voltage (Vf) of PDP, material with more this secondary electron yield is better
[0012] However, the secondary electron generated inside material needs to arrive at the **** front face which had as big energy as possible from consumption of energy arising in the process which moves even to a front face. The material of a ** electron affinity with a protective layer small for that purpose to a bird clapper, ** The big thing of the band gap (energy gap) of material, i.e., there are little the electron of a valence band and the probability of acting, ** -- it is required and is used out of candidates, such as a lanthanum trioxide (La 2O3) from this point, a cerium oxide (CeO), and MgO, choosing MgO with a

as large band gap as 7 electronu volt
[0013] Thus, although MgO is used as a formation material of a protective layer, in order to reduce the inter-electrode distance of PDP further, it is necessary to lower breakdown voltage (Vf) for a secondary-emission ratio (gamma) further using a big material, and it is possible to introduce an oxygen defect into MgO as one of the method of the.
[0014] If it does in this way, since many localized levels will come to exist in a forbidden band and electronic changes will take place from this level to the ground level of ion in an energy band scheme, it is expectable that a secondary-emission ratio (gamma) increases.
[0015] In fact, it is checked that breakdown voltage (Vf) falls [the direction in the case of forming at a room temperature] compared with the case where it forms performing substrate heating in case the protective layer which consists of MgO is formed by the electron-beam-evaporation method. However, an electric discharge sustaining voltage changes as the protective coat of PDP which carried out in this way and was formed is unstable with time and a charging time value increases.
[0016] Then, also with time, this invention is stable from replacing a part of oxygen (O) which constitutes MgO as a method of abolishing the instability of MgO and lowering breakdown voltage (Vf) by the fluorine (F), and F atom not replacing a part of O atom position of the grid which forms not an oxygen defect but MgO ionic crystal in this case, and not making a localized level to a forbidden band by O deficit, but making a localized level by the valency control.
[0017]
[Example] Drawing 2 is the cross section of PDP used for the experiment, and is thickness 2 mm. It is 20 micrometers about glass after carrying out pattern formation of the electrode 14 which consists of copper (Cu) by the vacuum deposition method and the photo-etching method on a glass substrate 13. It is MgO1-x-y Fy by the electron-beam-evaporation method on [after forming the dielectric layer 5 which forms in thickness and covers an electrode 14] this. The becoming protective layer 6 was formed.
[0018] The method is the single crystal grain of MgO, and MgF2. A single crystal grain is put into the water-cooled crucible made from copper (Cu) by the weight ratio of 10:1, where a glass substrate 13 is heated to 150 **, vacuum evaporationo is performed, and thickness is 300nm. The protective layer 6 was formed.
[0019] On the other hand, thickness is 2 mm as a counter electrode. After carrying out pattern formation of the electrode 17 which consists of copper (Cu) by the vacuum deposition method and the photo-etching method like the point on a glass substrate 18, It is 20 micrometers about glass. After forming the dielectric layer 15 which forms in thickness and covers an electrode 17, It is MgO1-x-y Fy by the electron-beam-evaporation method like the point besides. The becoming protective layer 16 is formed. These two glass substrates 13 and 14 30 micrometers Set an interval, it is made to counter, a cell is made and it is Ne-Xe in this. Mixed gas was supplied and enclosed and AC type PDP was formed.
[0020] And electrode terminals 19 and 20 When the voltage of 10kHz was impressed in between and breakdown voltage (Vf) was measured, even if it started electric discharge by 80V and passed 1500 hours, change of an electric discharge sustaining voltage was not accepted. The breakdown voltage (Vf) of PDP of structure is conventionally [which used MgO as a protective coat on the other hand] required for 90V [at least].
[0021]
[Effect of the Invention] In AC type PDP, breakdown voltage (Vf) could be lowered by operation of this invention, and, thereby, panel formation higher definition than before was attained.

[Translation done.]